REMARKS

A. Disclosure

The Examiner has objected to the disclosure under 37 CFR §1.71 as being incomprehensible. Specifically, the Examiner made the following comments:

"The following items are not understood: page 1 calls a first and second vessel wherein one of said vessel is a dock, it later connected the dock to a second vessel as well as the first vessel. Page 1 is confusing because it calls for "a production vessel to provide fluid to a tanker, via rigid cryogenic piping and a floating dock". Page 2 calls for range 50,000-150,000; however this is not what is called for on page 6. Page 6 the first nine lines are confusing."

Applicant respectfully submits that the disclosure clearly describes Applicant's invention. It is believed that the Examiner has simply misunderstood the disclosure.

As described at page 1, line 11-21 of the substitute specification, the subject invention is directed to an apparatus for transferring cryogenic fluids from a first vessel, referred to as a production vessel at line 18 to a second vessel, referred to a tanker at line 19. The transfer of fluid between the first and second vessels occurs via the floating dock, and a rigid pipeline which connects the first vessel to the floating dock.

This is more clearly set forth in the Detailed Description portion of the specification wherein the first vessel is indicated as a floating production barge 5.

The rigid cryogenic piping is identified as flow lines 6 which connect production barge 5 with floating dock (pontoon) 1. This is described at page 3, line 20 through page 4, line 6 and is shown in Fig. 1.

The second vessel is described as tanker 7 which docks with floating dock 1 as shown in Fig. 3 and described at page 4, lines 1-6 at page 6, lines 7-10.

Accordingly, Applicant respectfully submits that the disclosure as originally filed clearly identifies the first and second vessels as being separate from the floating dock.

Applicant notes the Examiner's comments that the ranges cited on page 6 of the specification do not match the ranges cited on page 2. Applicant has amended the specification at page 6 to correct a typographical error. The range specified on page 6 now reads 50,000 cubic meters (m^3) to 150,000 cubic meters (m^3) which corresponds to the range on page 2.

Finally, the Examiner has objected to the specification on the grounds it does not include the section headings called for in 37 CFR §1.77(b). Applicant has submitted a substitute specification which now includes the section headings.

B. Drawings

The Examiner has objected to the drawings on the grounds the drawings fail to include reference character 2c referred to on page 6 of the specification. Applicant has amended the specification to change the reference from Figure 2c to Figure 4.

Section 112 Rejection

The Examiner has rejected Claims 1-10 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The Examiner states that the claims are replete with indefiniteness and antecedent basis that are too numerous to mention. The Examiner gives as an example Claim 1 which the Examiner contends calls for a first and second vessel wherein one of said vessels is a dock with the claim later connecting the dock to a second vessel as well as the first vessel.

Applicant respectfully transverses the Examiner's rejection. As explained above in connection with the 37 CFR §1.71 rejection the Examiner has misconstrued the invention and the claims. Claim 1 clearly distinguishes between a first and second vessel and the floating dock. Claim 1 is directed to an apparatus which can be used to transfer fluid

between a first vessel and a second vessel. Applicant respectfully requests that the Examiner identify the specific language which the Examiner contends claims the dock as one of the first or second vessels.

Concerning Claim 4, Applicant has amended claim 4 to define the range as 20 to $25m^2$ as set forth in the specification.

Section 102 Rejection

The Examiner has rejected Claims 1-10 under 35 U.S.C. §§ 102(a) or (b) as being anticipated by Argy, Burbage et al., Poldervaart, Harley et al., Eide et al., Perera, et al., Lavagna et al. or WIPO WO00/27692. In support of the rejection the Examiner has stated:

"All the above reference disclose an apparatus for transferring cryogenic fluid from a first vessel to a second vessel in an off-shore environment, comprising a partly submerged floating dock, variable buoyancy means operable to alter the draught of the dock to enable engagement of the dock with the second vessel, a single point mooring system attached to the dock, at least one rigid cryogenic pipeline attached between the second vessel and the dock via flexible connection means, and means for transferring cryogenic fluid from the dock to the second vessel.

Applicant respectfully transverses the Examiner's rejection.

Argy, U.S. Patent No. 4,417,603

Argy is directed to a flexible heat-insulated pipe-line. Applicant respectively submits that Argy does not disclose each of the elements of independent claim 1 nor does it render any of the claims obvious.

Burbage, et al., U.S. Patent No. 6,390,733

Contrary to the contention of the Examiner, Burbage does not disclose a first vessel and second vessel and a floating dock for transferring fluid between the first and

second vessel. Burbage simply discloses a barge 14 which can be connected to an off-loading tanker 40. Burbage does not disclose each element of independent claim 1 nor does it render any of the claims obvious.

Poldervaart, U.S. Patent No. 6,517,290

Similarly, Poldervaarts discloses connecting submerged turret loading buoy (STL) to a tanker or connecting an offloading vessel to a tanker. Poldervaart does not disclose each of the elements of independent claim 1 nor does it render any of the claims obvious.

Harley et al., Publication No. 2003/0126132

Harley is directed to a single point mooring regasification tower in which a ship 12 can move to an offshore structure 10. Applicant respectfully submits that Harley does not disclose each of the elements of independent claim 1 nor does it render said claimed invention obvious.

Eide et al, U.S. Patent No. 6,637,479

Eide is directed to a system for transferring liquefied natural gas between two vessels (1 and 2), by means of flexible pipes 5. Eide does not disclose a floating dock or the utilization of a rigid pipeline for transferring the natural gas between the two vessels. Applicant respectfully submits that Eide does not anticipate the claimed invention nor does it render it obvious.

Perera, et al., U.S. Publication No. 2003/0224674

Applicant submits that Perera does not anticipate the claimed invention. Perera is directed to a system for preventing the clashing between multiple conduits spaced closely together. Perera does not disclose each of the elements of independent claim 1 nor does it render the claimed invention obvious.

Lavagna et al., U.S. Publication No. 2004/0077234

Lavagna is directed to a wave motion absorbing offloading system. Lavagna does not disclose a floating dock and does not anticipate independent claim 1 nor render the claimed inventing obvious.

WIPO, WO 00/27692

This reference is directed to an apparatus or system for positioning a vessel with respect to an underwater structure such as a well head 11. Contrary to the contention of the Examiner this reference does not anticipate the claimed invention nor render it obvious.

As set forth above, Applicant respectfully submits that none of the references cited by the Examiner anticipate Applicant's claimed invention. If the Examiner is still of the opinion that one or more of the reference are anticipatory Applicant respectfully requests that the Examiner identify the specific elements of the reference which correspond to the elements of the claims.

Applicant respectfully submits that the instant application is now in condition for a Notice of Allowance and the issuance of said Notice of Allowance is earnestly requested. If any informalities remain which need to be addressed in order to put the application in condition for a Notice of Allowance the Examiner is requested to telephone the undersigned attorney.

If any additional fees are due, please charge our deposited account no. 21-0800.

Respectfully submitted,

FULWIDER PATTON LEE & UTECHT, LLP

By: _____

Gary M. Anderson
Registration No. 30,729

GMA:spc
200 Oceangate, Suite 1550
Long Beach, CA 90802
Telephone: (562) 432-0453
Facsimile: (562) 435-6014
Customer No. 27629

APPLICATION

of

JACOB DE BAAN

for

UNITED STATES LETTERS PATENT

on

OFF-SHORE MOORING AND FLUID TRANSFER SYSTEM

Client ID/Matter No. BLUE.65488

Sheets of Drawing Figures: 4

Express Mail Label No. EV 320199544 US

Attorneys
FULWIDER PATTON LEE & UTECHT, LLP
200 Oceangate, Suite 1550
Long Beach, CA 90802

OFF-SHORE MOORING AND FLUID TRANSFER SYSTEM

FIELD OF THE INVENTION

The present invention relates to a system for transferring fluids, especially cryogenic fluids, to a vessel in an off-shore environment.

BACKGROUND OF THE INVENTION

Such fluid transfer currently requires transport tankers to come into very close proximity to a production barge. This is hazardous due to the nature of the products concerned, such as ~~liquified~~ liquefied natural gas (LNG) and the capital-intensive equipment which must be employed.

SUMMARY OF THE INVENTION

The present invention provides apparatus for transferring cryogenic fluid from a first vessel to a second vessel in an off-shore environment, comprising a partly submerged floating dock, variable buoyancy means operable to alter the draught of the dock to enable engagement of the dock with the second vessel, a single point mooring system attached to the dock, at least one rigid cryogenic pipeline attached between the first vessel and the dock via flexible connection means, and means for transferring cryogenic fluid from the dock to the second vessel.

Thus, the present invention allows a production vessel to provide fluid to a tanker, via rigid cryogenic piping and a floating dock which has an extremely benign response to the environment, i.e. it moves very little in response to wind and wave action. This means that rigid flow lines become feasible in terms of strength and fatigue life. Such rigid pipelines are considerably cheaper than flexible flow lines and require less maintenance and less frequent replacement.

Preferably, there are two or more rigid pipelines between the dock and the first vessel and means enabling a return flow of fluid received at the dock from one pipeline to a second pipeline. This can be used when no second vessel is engaged with the dock and such recirculation of fluid helps to keep the temperature of the fluid down to the required level.

In a preferred embodiment, the single point mooring system comprises a turret rotatably mounted to the dock and anchor lines attached to the turret. The turret may be mounted with its centreline forward of a leading edge of the dock, or rearward of a leading edge by approximately 20 to 50% of the length of the dock.

Preferably, the dock itself comprises a floor structure engagable against the hull of the second vessel and a plurality of columns projecting upwardly from the floor structure, wherein the cross-sectional area of the columns at the waterline is in the region of 20 to 25m^2.

The variable buoyancy means in the dock may comprise ballast compartments extending between the columns above the waterline.

The variable buoyancy means may further comprise ballast compartments located in the floor structure beneath the waterline.

Advantageously, the dock is designed to accommodate tankers having a load capacity in the range from 50,000 to 150,000m^3.

Furthermore, the dock may be provided with a position control system and thrust producing devices, to enable it to be aligned with an approaching tanker for ease of docking.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in detail, by way of example, only with reference to the accompanying drawings in which:

Figure 1 is a schematic view of the mooring and transfer system in accordance with a first embodiment of the first invention;

Figure 1a is an enlarged view of the end of the production barge and the attached pipeline as seen in Figure 1;

Figure 2 is a schematic side view of the floating pontoon of Figure 1;

Figure 2a is a cross-section of Figure 2 on the line A-A;

Figure 2b is a cross-section of Figure 2 along the line B-B;

Figure 3 is a schematic view of the pontoon of Figures 1 and 2 engaged with a tanker; and

Figure 4 is a perspective view of the floating pontoon of Figures 1 to 3.

DETAILED DESCRIPTION OF THE INVENTION

A first embodiment of the present invention is illustrated in Figure 1. The mooring and fluid transfer system includes a floating dock in the form of a pontoon 1 formed by two rows of substantially vertical columns 7 projecting both above and below the water line. Below the water line the two rows are joined by a network of longitudinal and lateral horizontal limbs 20, 21. Above the waterline, the columns 7 in each row are joined by longitudinal limbs 22. This is best seen in Figure 4. The pontoon 1 is designed to have a small water line area and a relatively high mass.

An anchoring system 2, which allows the pontoon 1 to weathervane around a single point mooring system 3, is attached to the pontoon l. A position control system with thrust producing devices 4 integrated into the pontoon 1 allows adjustment of the position of the pontoon 1 in the sea against the restoring force of the anchoring system 2. Thus, the position of the pontoon 1 can be altered to assist with alignment with an approaching tanker, so that the tanker can pass between the two rows of columns 7 for docking.

The pontoon 1 is fitted with means to regulate its draught so that it can be raised in the water to dock against the underside of a tanker with excess buoyancy force, such that the horizontal friction between the pontoon 1 and the tanker is sufficient to ensure that both structures move in unison under the effect of sea current and wind forces.

The pontoon 1 is fitted with means to receive cryogenic fluids from a floating production barge 5 moored some distance away, such as around 2000m. This means comprises of one or more flow lines 6 suspended between the production barge 5 and the pontoon l. The flow lines 6 may be single or doubled walled steel pipes, with or without insulation material as the need to conserve heat dictates.

The flow lines 6 are attached to the pontoon 1 by a connecting member 9, best seen in Figure 2, which may be a chain, wire or a rod. The end 10 of the flow line 6 is connected to a flexible hose 11 which is in turn connected to the single point mooring system 3 to provide a fluid pathway between the flow line 6 and the pontoon l.

As seen in Figure la, the connection point of the flow lines 6 to the production barge 5 may include means 19 to support the flow lines 6 in a resilient manner if required due to the combination of outside flow line diameter and wave height/wave climate at the site of operation of the mooring and transfer system. The resilient means 19 may take the form of a piston and cylinder arrangement for example.

As mentioned above, the pontoon comprises a number of substantially vertical columns 7 which have a relatively small water line area, typically 20 to 25m^2, but can have a larger diameter portion 8 as seen in Figure 2, well above the water line to provide reserve buoyancy.

The pontoon 1 is also fitted with ballast water compartments 14 above the water line [[and]] <u>in</u> the limbs 22, and sea water inlet tanks 15 below the water line in the limbs 20 to enable the buoyancy of the pontoon to be varied and a quick docking and undocking procedure to a tanker keel to be achieved.

The single point mooring system 3 includes a cryogenic fluid swivel to provide a fluid flow path from hose 11 to the pontoon l. The pontoon 1 is also fitted with means 12 to connect the pontoon 1 with the manifold of a tanker docked with the pontoon 1. The single point mooring 3 is preferably executed as a so-called turret system, with anchor lines 2 connecting the turret 23 to the sea bed and the turret 23 being rotatably fitted to the pontoon l. The centreline of the turret may be located at the forward edge of the pontoon 1 as illustrated in Figure 2a in solid lines as position 1. This increases the directional stability of the pontoon 1 in the sea. However, in some situations it may be advantageous to locate the turret 23 at approximately 20 to 50% of the pontoon length behind the forward edge. This is illustrated in dotted lines as position 2 in Figure 2a.

Preferably two flow lines 6 are provided. Each may be of approximately 26" outside diameter and approximately 20" inside diameter, with insulation therebetween, so as to be suitable for carrying cryogenic fluids. The flow lines 6 may include buoyancy aids 24 to support the mid-portion of the flow lines 6. Preferably, when suspended between the pontoon 1 and the barge 5 the flow lines 6 lie at approximately mid depth of the body of water concerned so as to minimize heat influx from warmer surface waters. The fluid in the flow lines 6 can be maintained in a cold condition by

re-circulating the fluid through the two flow lines and the piping on the pontoon 1 when there is no tanker docked in the pontoon l.

The pontoon 1 may be fitted with a power plant 13 intended to drive its propulsion system 4, and a boil-off gas compressor and re-liquification plant for vapor discharged from the tanker when loading cryogenic fluid. This power plant 13 may operate on such vapors or boil-off gas from the flow lines 6 when no tanker is present.

The lay-out of the pontoon 1 is designed such that when a tanker is docked with the pontoon, the turret of the single point mooring system 3 is located in the forward third of the tanker length, and the length of the pontoon 1 is such that it just projects past the tanker's mid-ship manifolds. This is illustrated in Figure 3.

Preferably, the pontoon 1 consists of four vertical columns 7 on each side spaced approximately 70 meters apart. It can accommodate tankers in the range of ~~50,0004 cubed~~ 50,000 cubic meters (m^3) to ~~150, 0001 meters cubed~~ 150,000 cubic meters (m^3) and the width' of the pontoon 1 between opposing columns 7, seen in Figure [[2c]] 4, does not exceed the width of the tankers to be accommodated. The pontoon is preferably designed to operate in wave heights up to about 4 meters. The subsea horizontal members of the pontoon are provided with suitable resilient means 17 to allow the pontoon 1 to safely engage against the underside of the tanker keel. In addition, a resilient energy absorbing element 18 is placed at the end of each of the longitudinal limbs 20 to absorb differential motions between the tanker and the pontoon 1 during docking.

CLAIMS

1. Apparatus for transferring cryogenic fluid from a first vessel to a second vessel in an off-shore environment, comprising a partly submerged floating dock, variable buoyancy means operable to alter the draught of the dock to enable engagement of the dock with the second vessel, a single point mooring system attached to the dock, at least one rigid cryogenic pipeline attached between the first vessel and the dock via flexible connection means, and means for transferring cryogenic fluid from the dock to the second vessel.

2. Apparatus as claimed in claim 1, further comprising two or more rigid pipelines between the dock and the first vessel and means to enable the return of fluid received at the dock from one pipeline to a second pipeline.

3. Apparatus as claimed in claim 1, wherein the single point mooring system comprises a turret rotatably mounted to the dock and anchor lines attached to the turret.

4. Apparatus as claimed in claim 1, wherein the dock comprises a floor structure engageable against the hull of the second vessel and a plurality of columns projecting upwardly from the floor structure, wherein the cross-sectional area of the columns at the water line is in the region of 29 to 25m^2.

5. Apparatus as claimed in claim 1, wherein the dock us designed to accommodate tankers in the range from 50,000m^3 to 150,000m^3.

6. Apparatus as claimed in claim 1, wherein the dock further comprises a position control system and thrust producing devices.

7. Apparatus as claimed in claim 3, wherein the turret is mounted with its centerline forward of a leading edge of the dock.

8. Apparatus as claimed in claim 3, wherein the turret is mounted with its centerline rearward of a leading edge of a dock by approximately 20 to 50% of the length of the dock.

9. Apparatus as claimed in claim 6, wherein the variable buoyancy means comprises ballast compartments extending between the columns above the water line.

10. Apparatus as claimed in claim 6, wherein the variable buoyancy means further comprises ballast compartments located in the floor structure beneath the water line.

ABSTRACT

Apparatus is described for transferring cryogenic fluid from a first vessel (5) to a second vessel in an offshore environment. The apparatus comprises a partly submerged floating dock (1) with variable buoyancy means (14, 15) operable to alter the draught of the dock (1), enabling it to be lowered in the water and raised again to engage the dock (1) with the second vessel. A single point mooring system (3) is attached to the dock (1) via flexible connections means (11, 19).

1/4

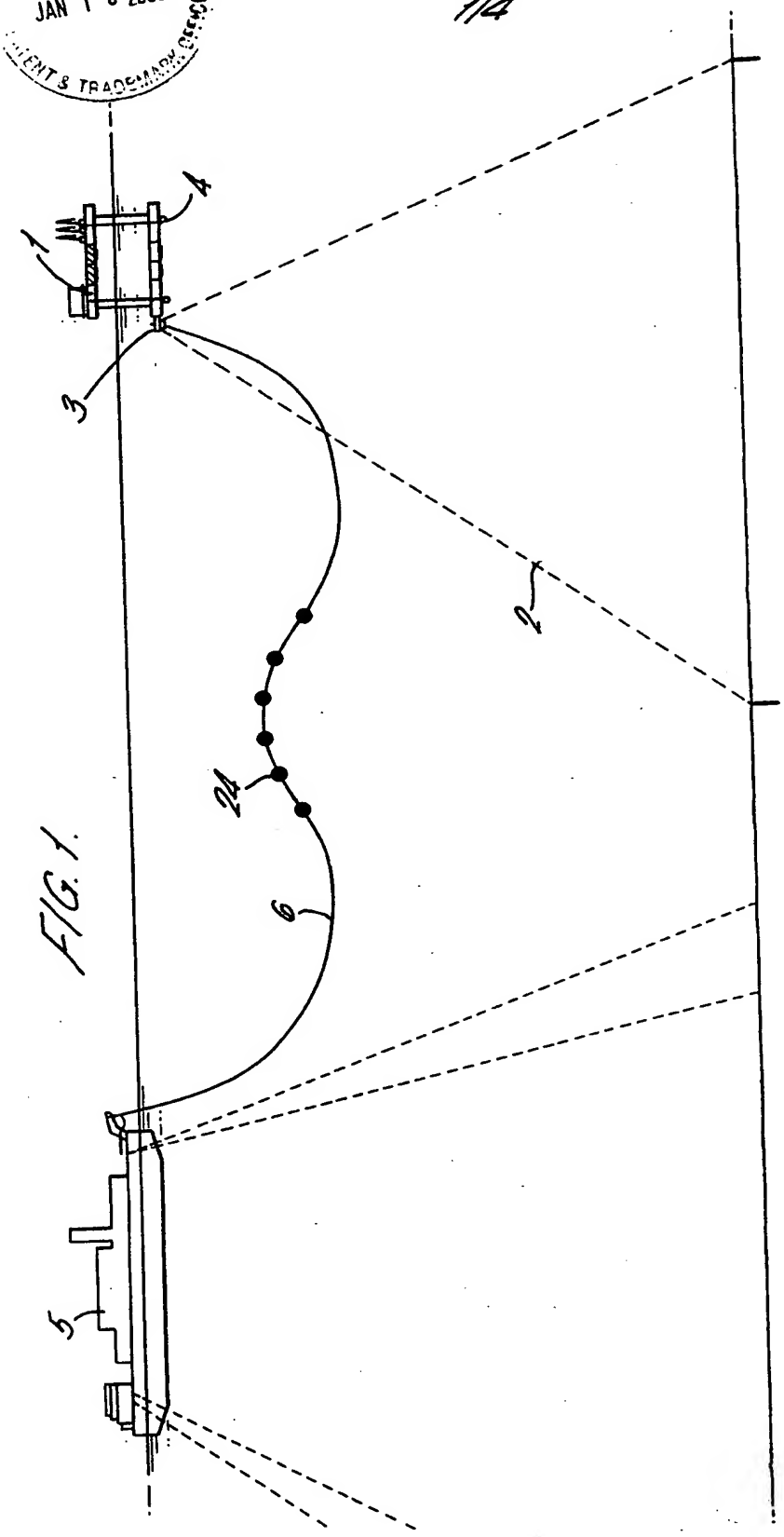


FIG. 1.

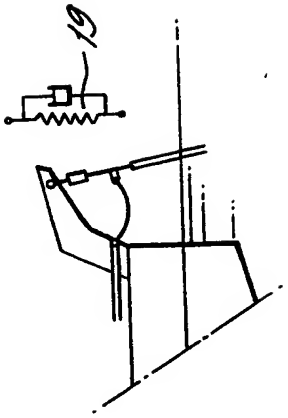


FIG. 1a.

2/4

FIG. 2b.

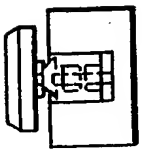


FIG. 2a.

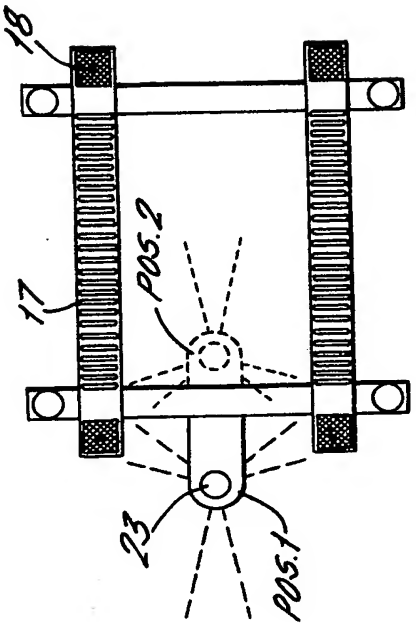
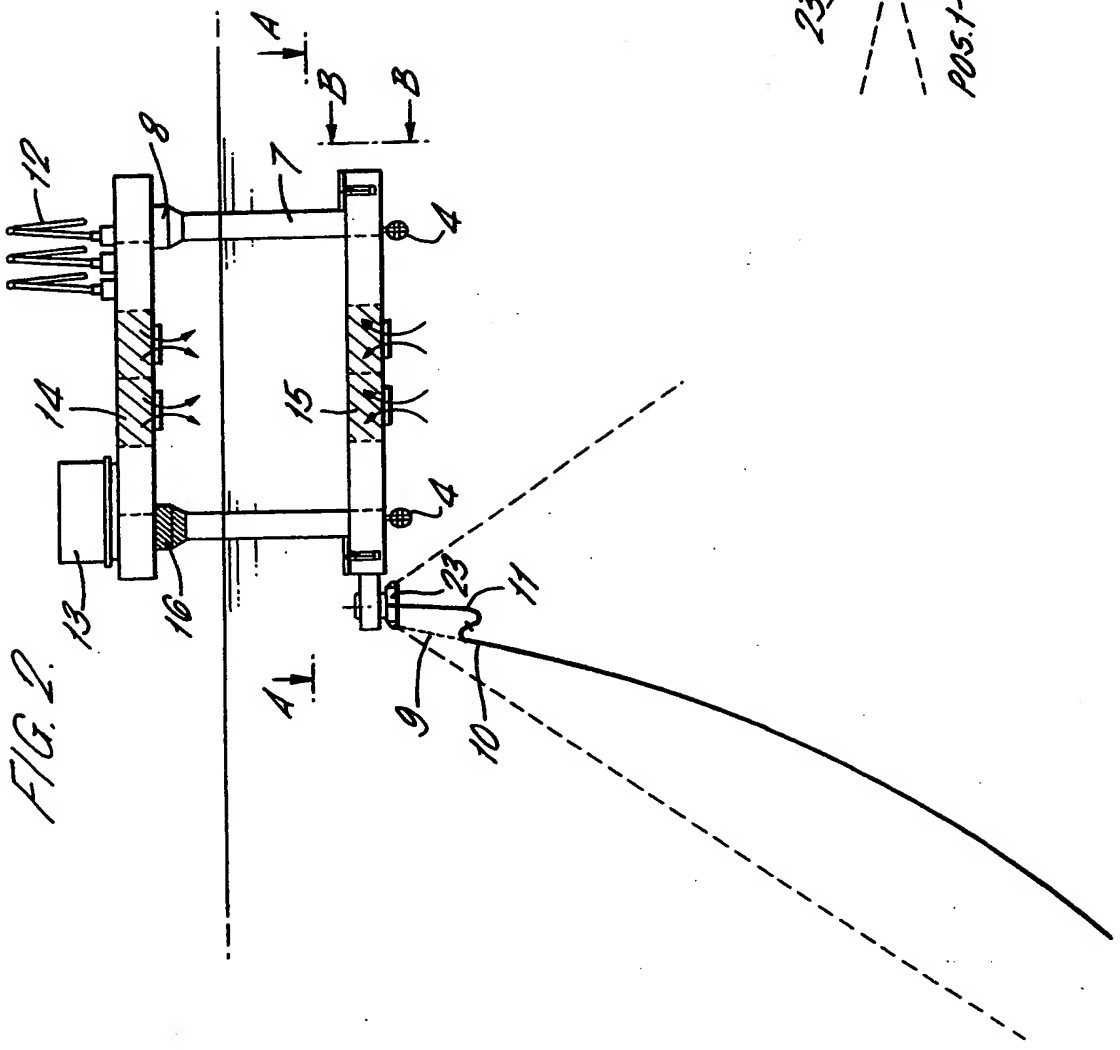


FIG. 2.



3/4

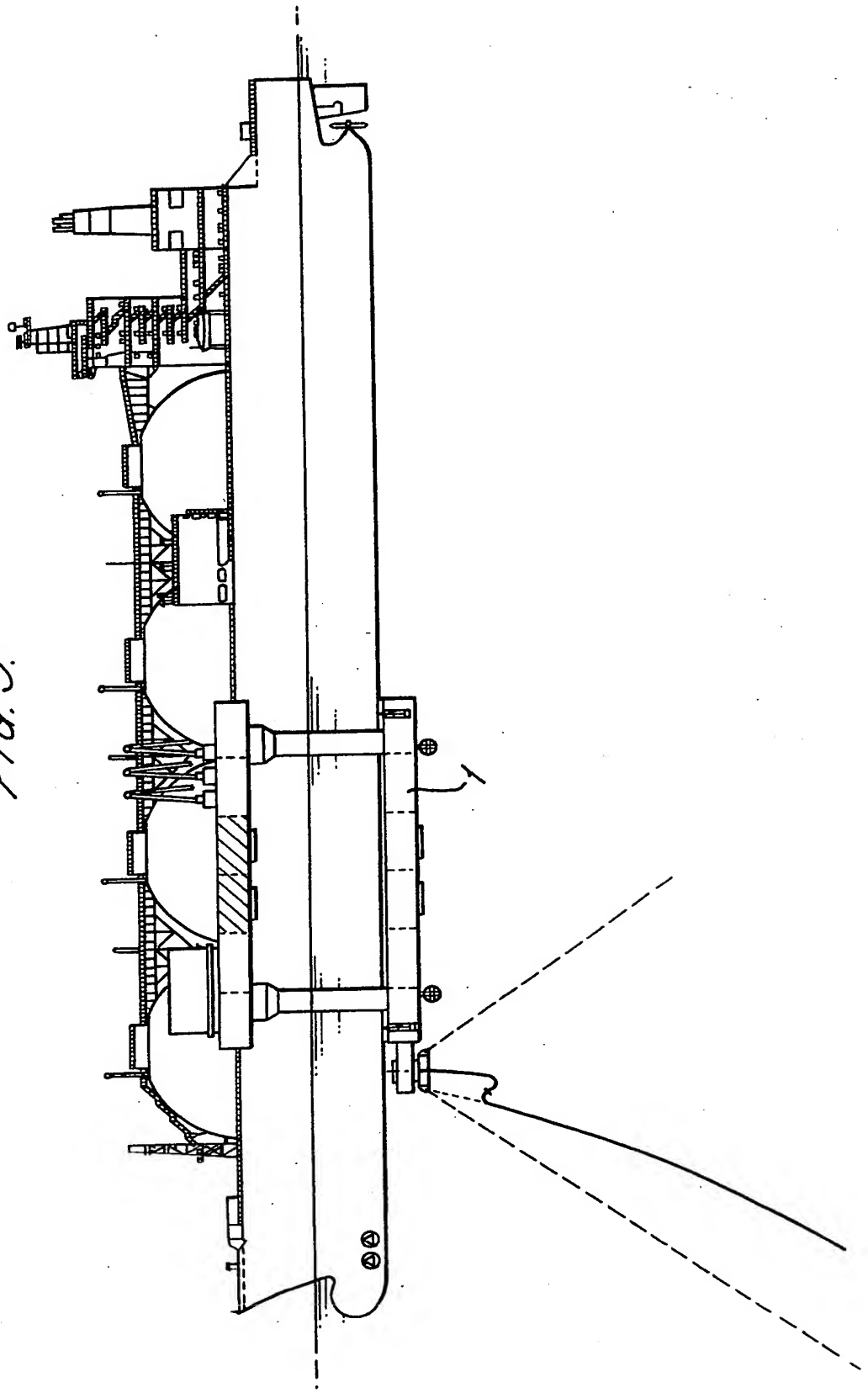


FIG. 3.

4/4

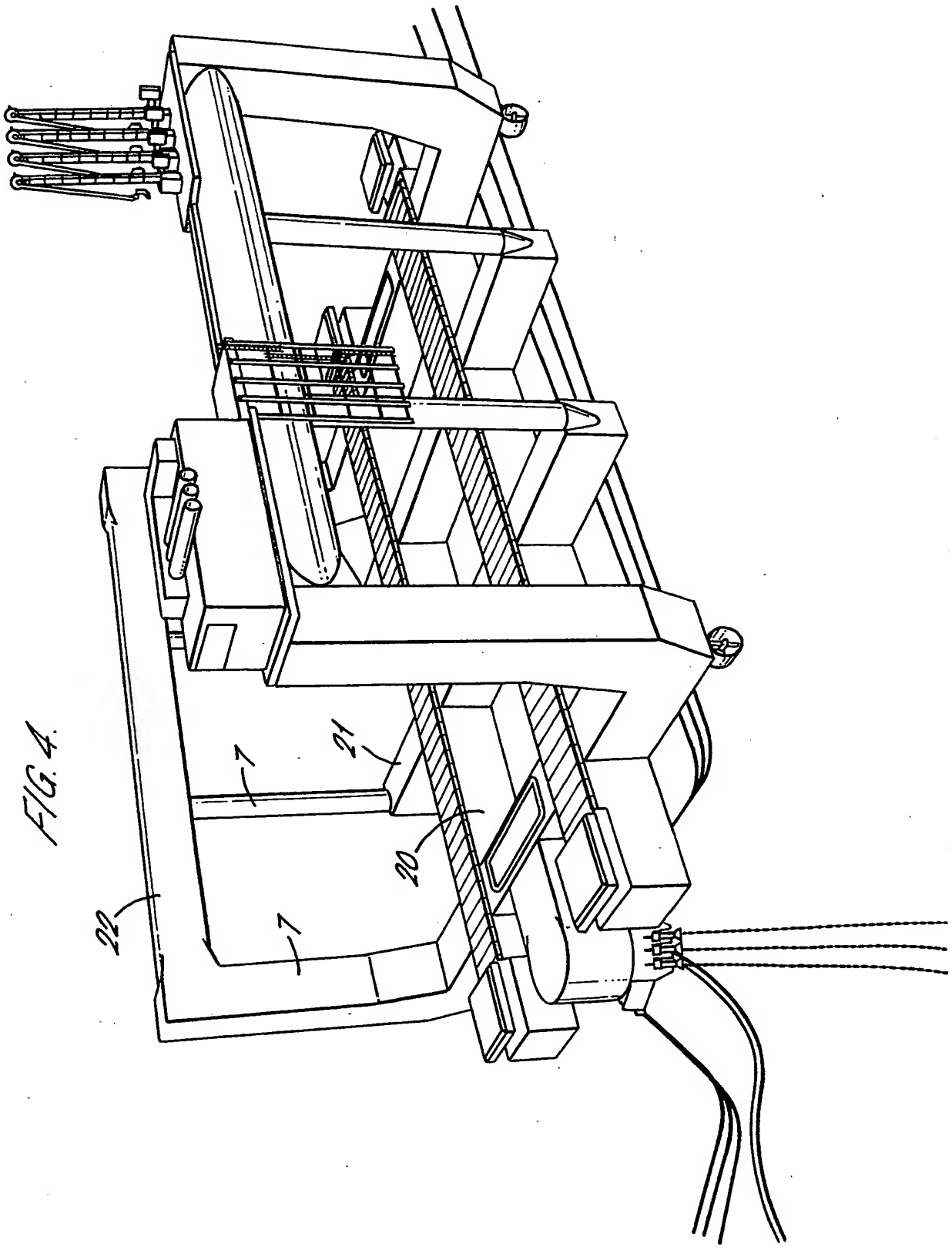


FIG. 4.